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The Profession of Forestry

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INCLUDING

An Address

BY

MR. GIFFORD PINCHOT

Chief of the Bureau of Forestry, U. S. Dept. of Agriculture.

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AND AN ARTICLE ON

Study in Europe for American Forest Students

BY

OVERTON W. PRICE,

Supt. of Working Plans, Bureau of Forestry.

Also a List of Reference Books on Forestry

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PREFACE.

"As yet forestry in America is young. In its progress toward maturity it must develop new methods to meet the unfamiliar conditions with which it has to deal. Rules and practices which were devised without reference to American forests cannot always be counted on to fit American needs. Perhaps nothing has done more to retard the progress of forestry in America than the disregard of its intimate and friendly relation to lumbering—a relation which was almost wholly overlooked for years after the advocates of forest protection first brought their cause to public attention. In the eyes of many of its early friends the lumberman was a vandal whose inordinate greed called for constant denunciation, while to the lumberman the ideas of the forest reformer had no relation whatever to the affairs of practical life. Since that early day lumbermen and foresters have been drawing together, and much progress has been made toward the right opinion, which may be expressed by saying that lumberman and forester are as needful to each other as the axe and its helve. Without the axe the helve has little weight; without the helve the axe is lacking both in reach and in direction."—*Gifford Pinchot: The Adirondack Spruce. Preface.*

THE PROFESSION OF FORESTRY.

An address delivered before the students of Yale University.

(Reprinted from the Yale Alumni Weekly by permission. Revised.)

BY GIFFORD PINCHOT, FORESTER OF THE U. S. DEPARTMENT OF AGRICULTURE.

THE subject matter of the profession of Forestry is equally distinct from street tree-planting on the one side and landscape architecture on the other. It has to do with wooded regions, with the productiveness of forests, chiefly through conservative lumbering, and, in the treeless parts of the United States, with planting for economic reasons. Except for a comparatively small area of desert land in the West, the whole land surface of the United States is included in the possible field of work for the forester. How extensive this field is will appear from the fact that the woodland in farms alone, in 1890, comprised more than 200,000,000 acres, or more than four times the area of the National forest reserves.

THE OPENING.

The first question asked by a man who has in mind forestry as his profession usually concerns the chance of finding work when his preparatory study is ended. The sources of demand for trained foresters at the moment are comparatively few, but they are increasing with remarkable rapidity. The great lumbering concerns, such as the International Paper Company, which controls more than 1,000,000 acres of Spruce land, are rapidly getting to see that it is worth their while to employ trained foresters. One Yale man has been employed by the company just mentioned; another college graduate, not a Yale man, has charge for a company of certain phases of its lumbering in Maine; and five lumber companies have already applied to the Bureau of Forestry for working plans for the management of their tracts. The demand from this source may be expected to increase very greatly within the next ten years, as the great holders of timber land come to realize more generally that conservative lumbering pays better than the destructive methods now employed.

In a similar way mining companies will eventually find it to their interest to employ foresters. The owners of game parks have already taken steps in this direction. Private owners of large areas such as Biltmore Forest in North Carolina, the property of George W. Vanderbilt, Ne-Ha-Sa-Ne Park in the Adirondacks, owned by W. Seward Webb, a Yale man, and the contiguous land held by the Hon. Wm. C. Whitney, another Yale man, are already under the management of trained men. The need of foresters to care for the forest interests of the several States is already making itself felt. States such as New York, with its million and a quarter acres of forest reserves; Pennsylvania, with its newly-created Department of Forestry and its growing State forest reserves; Michigan, with its Forest Commission and its State reserves which are being rapidly formed; North Carolina, with its Geological Survey thoroughly interested in forest study; New Jersey and Maryland, of which the same is true; Maine, New Hampshire and several others, with their Forest Commissions; Minnesota, with its Fire Warden law, its State Park and the beginning of a system of State forest reserves, and other States are rapidly creating a demand for foresters, and would be doing so still more rapidly if men were available to do the work. Finally, the National Government already employs a considerable number of men, and is rapidly extending the work which requires them. The General Land

Office, to which is intrusted the police and patrol of the National forest reserves, has this year an appropriation of $300,000 for the care and protection of about forty-seven million acres of forest reserves. At present there are no trained foresters among its officials, but in view of the vital importance of forest preservation, especially in the West, and of the great and growing public interest in its extension, this system of appointment cannot be expected to last.

The Bureau of Forestry, which is charged with the general progress of forestry and the interests of private forest lands, in the subdivision of the Government's forest work, is at this moment unable to find enough suitably trained men to supply its needs. It would be easily possible, it is true, to secure Germans or other foreigners, but a considerable experience has convinced me that, except in rare cases, such as that of the present forester to the Biltmore Estate, the attempt to use foreign-born men trained abroad is not likely to succeed.

COMPENSATION.

The second question asked by the prospective forester very often relates to the rate of pay. I cannot answer this question any more accurately than by saying that trained foresters now receive about the same rate of pay as instructors and professors at Yale. Those in the employ of the Bureau of Forestry receive from $720 to $2,500 a year. Scientific work under the Government is always underpaid, and it is most probable that those foresters who enter the service of lumber companies or other commercial organizations will fare better. It is even possible that a few men may develop such skill that they will be called in consultation over specially difficult problems. Such work will naturally pay well.

As with teaching, so with forestry; by no means all the compensation comes in the form of dollars. While the life of the forester in the field is often rough, many times exceedingly hard, and always without most of the comforts of life, it is to those of us who have been following it the most delightful of occupations. Briefly stated, it deals, on the scientific side, with the life-history of forests and forest trees, with their behavior in health and disease, their reaction under treatment, and their adaptation to and effect upon their surroundings. On the economic side, it has chiefly to do with reconciling the perpetuation of the forest with the production of timber. Measurements of the stand of timber per acre, and of the rate of growth of single trees and whole forests by counting rings, and subsequent calculations, often form a consideraable part of a forester's work. There is often a great deal of office work. It is by no means the easy existence it has often been supposed to be by the many men who have taken up forestry, and then have dropped it. But it has a charm which lies perhaps first of all in the fact that in the United States it is almost an untried field.

ORIGINAL WORK DEMANDED.

Unless forestry as a profession has qualities to recommend it other than those I have already mentioned, it would scarcely be worthy of consideration before many other lines of work. It has, however, two peculiarities in which it stands somewhat by itself. In the first place, because the field is practically untouched, a forester finds himself compelled to do original work at every turn. The pleasure of investigation of this kind is very real, and to those of us who are practicing forestry it is one of its two great attractions. The second lies in the fact that because forestry is almost unknown in the United States, in no profession is it easier for a man to make his life count. I need not dwell further on the vastness of the interests it touches nor the great utility of forestry to the nation, but I should like to emphasize this statement—in few other professions can a man lead so useful a life.

WHAT THE PROFESSION DEMANDS.

These are the things which forestry offers. Now as to what it demands. In the first place success in forestry, as in any other profession, must come largely from

the possession of what we know so well as "Yale spirit," the habit of accomplishment and the willingness to do the work first and count the cost afterward. It is interesting to note here that a majority of the young Americans who have fitted themselves for technical forest work are Yale men. Whatever the connection or the special fitness may be which brings Yale men into this line of effort and achievement, I should like to see the recruits from Yale come in fast enough to maintain something like the old proportion.

After the "Yale spirit" comes soundness of body and hardiness, for foresters must often expect the roughest kind of life in the woods. The helpmeet of hardiness is a contented spirit. There is no more pernicious character than a grumbler in camp, and nothing will help so much to get field work done as the willingness to bear privation cheerfully.

A man who takes up forestry will often find the field work exceedingly or even unexpectedly hard, for it combines severe mental work with severe bodily labor, under conditions which make each one peculiarly trying. Work in the woods differs profoundly from camp life as it is usually understood. Foresters get a certain amount of hunting and fishing, and every forester will do his work better for a wholesome love of the rod and gun, but the line between work and play is still sharply drawn.

I have been speaking of the fundamental qualities which are more or less necessary to success in any vigorous outdoor life. There are several additional capacities with which the forester should be well endowed. The first of these is the power of observation. It is often difficult to say *a priori* whether a man has it or not. In many cases it makes itself known as a love of hunting or fishing, or a general pleasure in all outdoors. To the forester it is one of the most essential qualities in his mental equipment. Finally, perseverance, initiative, and self-reliance are peculiarly necessary, because the forester is so often withdrawn from the inspection of his superiors and altogether dependent on his own steadfastness and devotion to keep him up to the high standard he should set himself for his work. In a new field of effort this is especially likely to be true. It is one of the distinguishing characteristics of the profession of forestry.

PREPARATION.

The preparation for forestry as a profession should, as a rule, begin with a college or university course, and, as a rule, should be continued after graduation for not less than two years.

The first step in the preparation for forestry as a profession is for the possible forester to discover whether his conception of forestry is a right one. To do so he must get into the field. The Bureau of Forestry made some provision to meet this requirement when it established the grade of Student Assistant, with pay at the rate of $300 a year. Men who take this position are required to assist in the work of the Bureau with the same steadiness and devotion to duty as in all its other members, and they are employed so far as possible in work of peculiar value to them and at the same time of use in the general progress. All their expenses are defrayed while in the field. In addition to the specific advantage this grade offers in enabling a man to take part in actual forest work under a trained forester, and so to discover what the profession really means, it has a special usefulness in enabling men who cannot at first afford fuller preparation to support themselves for a time while getting the first step in their forest education. It does not replace a forest school, nor is it the intention that it should. No future forester who can possibly afford to take a course, either at Cornell, under Dr. Fernow, at Biltmore, under Dr. Schenck, or at Yale, under Professor Graves should fail to do so. I repeat with all emphasis that work as a student assistant cannot take the place of study at a forest school.

The number of positions as Student Assistant is decidedly limited, and graduates or students of forest schools will always be preferred for appointment. No one will be received as Student Assistant

who has not definitely made up his mind to take up forestry as a profession, although of course no pledge to that effect is required.

In my judgment the best course for the future forester to pursue, so far as his systematic training is concerned, is first, a full course at a university during which he should acquire some knowledge of the auxiliary subjects necessary in forestry; second, at a forest school, preferably where practical work in the woods goes hand in hand with theoretical instruction; and third, a year abroad. The latter is of the greatest value, because in this country forestry is too young to show the effect of silvicultural treatment on the various kinds of forests; yet it must be remembered that much of what is learned abroad must be unlearned later. This experience in a region where forestry is of old date is, in my judgment, a most essential portion of a forester's education. It goes without saying that vacations, as far as possible, should be spent in the woods.

Forestry on its executive side is closer to lumbering than any other calling, and a good knowledge of the lumberman's methods is an essential part of a forester's education. But it must not be forgotten that it offers a field for pure research of the widest and most attractive character for those who are inclined and can afford to occupy it. It is so broad a subject that as yet we do not quite know what its development and its subdivisions are going to be.

GIFFORD PINCHOT.

STUDY IN EUROPE FOR AMERICAN FOREST STUDENTS.

BY OVERTON W. PRICE.

Superintendent of Working Plans, Bureau of Forestry.

THE training necessary for an American forester has not yet been fixed by hard and fast lines. The necessity, however, for a man to map out his course and to supply his deficiencies largely on his own responsibility has disappeared with the establishment of American forest schools. They have already done much to set a high standard for technical training and thereby to hasten greatly the sound development of forestry in this country. With the creation of opportunities for systematic study at home, it is natural for the forest student to jump to the comfortable conclusion that study abroad is no longer essential. He soon becomes aware also of the familiar fact that European forest methods can rarely be applied without modification here, and this may seem to him to remove all practical advantage from studying them on the ground. He sees, too, that there are now fewer trained men in this country to supply the need for foresters than there are likely to be in the future, and he naturally wants to get his start with as little loss of time as possible.

It is true that there are few European forest methods which we can use entirely without modification. It is also true that European methods have been rich in suggestion in the application of practical forestry to American forests. The American forest student who puts aside a chance to see forestry in Europe makes the same sort of mistake that a medical student would be guilty of, who ignored an opportunity to walk the best hospitals. The work which falls to a forester here requires of him a more comprehensive grasp of his profession than is needed where forestry is already established upon a firm footing. In Europe, forest management, in order to be successful, has only to follow those methods which have been proved advisable. In this country, the forester must depend for the most part upon his own ability to make the most of forest problems. And since he has but few patterns to follow at home, it would seem that the more

he knows of the practice and development of forestry abroad, the better equipped will he be for his work.

Three questions are likely to present themselves to the forest student who has decided to supplement in Europe the course of study which he has followed here: where to go, how long to stay, and the probable cost of the undertaking.

Those who have been well grounded at a forest school and have seen something of American forests and American lumbering, can gain much from a year abroad. Those who wish to follow to the end a particular line of investigation may use two or three years to advantage, but for the usual purpose of the forest student, one year will suffice. The right man, equipped with a good knowledge of German and a carefully considered plan of campaign, can gain something from a six months' stay. It requires, however, a thorough preparatory knowledge of European forest conditions, to lend practical benefit to a shorter trip. The disadvantage for the forest student of flying trips to Europe can scarcely be put too strongly.

The forest student, with one year abroad at his disposal, will probably find it advisable to spend the first one or two months, according to his requirements, on one range under an English-speaking forest officer. This will enable him to brush up his German without loss of time, and steady work in the same place for a month or more will give him the insight into European forestry which he needs, much better than would the same period spent in a cursory inspection of several ranges. English-speaking forest officers are rare in Europe. The Uehlingen range in the Southern Black Forest, under the charge of Oberförster Jäger, has been the starting point for several American students, and it would be difficult to find one more favorably situated or a forest officer with a happier faculty for making matters clear to the beginner. While at Uehlingen the student will have a chance to acquaint himself thoroughly with the Baden working plan method, which, of the several in force in the German States, is the simplest, the broadest, and the least unsuited to American forest conditions. Uehlingen is within easy reach of several instructive ranges, among which are Waldshut, St. Blasien, and Wolfsboden. The Waldshut range in the foothills of the Schwarzwald, where the vineyards of the Rhine valley give way first to coppice woods and then to high forests of Beech and Oak, forms a strong contrast in type and management to Wolfsboden and St. Blasien, both mountain ranges stocked chiefly with Silver Fir and Spruce.

His term at Uehlingen ended, the student will do well to see something of Swiss forests before he turns northward. The Sihlwald, town forest of Zurich, deservedly famous for its Beech forests and the excellence of its management, is full of interest and of practical hints. There are records of its systematic management since 1417. It is the only range in Europe in which all its own forest produce is worked up. It has a sawmill, lathes for turning tool handles, a plant for impregnating paving blocks and telegraph poles, and machines for the shaping and bundling of fuel. No raw material is sold. The Sihlwald contains also a most ingenious and labor-saving system of timber slides, firewood slides, and forest railways.

The town forest of Winterthur does not contain many features from the study of which Americans can gain direct practical benefit. It is instructive, however, in showing what exceedingly favorable local conditions can do in shaping the management of a forest. The well-stocked Winterthur forests, which begin within a stone's throw of the town, have produced a revenue of $10 per acre per annum for the last thirty years. They are managed with almost the same care that we give to a garden, because through their nearness to an excellent market the value of firewood and timber exceeds enormously the cost of raising them.

Whether the student sees something of forest management in the Swiss Alps, or in those of Bavaria or the Tyrol, will depend upon the best economy of his time. It is preferable that he should see it in Switzerland, where the preservation of the forests of the higher mountains is of vital

importance. It was in Switzerland, that reckless lumbering of the mountain forests resulted in such serious damage from landslides and avalanches to farms in the Alpine valleys, that an urgent and successful public appeal was made to the Government to take their management into its own hands.

On his way northward from Switzerland, the student will do well to see some ranges of the middle and northern Schwarzwald. Of the former, Staufen is the best known. It is the largest range in Baden, and the management of its mountain forests is particularly instructive. Of the latter, the ranges of Baden-Baden, Wolfach, and Herrenwies are representative. Wolfoch, an excellent example of the selection system, is full of suggestion for American foresters.

It is but a short distance into Bavaria from the northern Black Forest. Bavaria is rich in forests and presents a very wide range of local conditions. The Spessart is well known and teaches forcible lessons in silviculture and national economy. It has been thought best to describe this forest district at some length since no American student abroad will fail to see it, while its form of management may be of some interest to those who confine their studies to is country.

The Spessart which is situated in the northwestern portion of Bavaria covers an area of about 115,000 acres. There are few forests of the same size, the wholesale lumbering of which would realize so enormous a profit. The stand is chiefly Beech and Oak, many of the latter 400 years old, with a diameter of three feet or more and a clear length of sixty feet—certainly the finest Oak in Europe and sometimes equalled, but seldom excelled, by the White Oak of our Southern and Middle States. One can walk for hours in this district among Oaks worth from fifty to two hundred dollars a tree and the total value of this timber in the Spessart is estimated at nearly one million dollars.

Bavaria is not a wealthy kingdom. Wars and enforced preparation for war, a generally unfruitful soil, the extravagances of the royal house, and, especially in the south, and idle and pleasure-loving peasantry, have all led to poverty. Under the careful husbandry of the present ruler, Luitpold, Prince Regent, much has been done to improve matters and especially to remove the heavy load of debt laid upon the people by the vagaries of the unhappy King Ludwig II. However, Bavaria is not yet in such a position that the presence of an additional million of dollars in the treasury would be a matter of little importance. In view of this, her conservative management of the wealth of the Spessart is all the more praiseworthy.

The villages in the valleys of the Spessart and upon the outskirts of the forest owe their existence to the wood-working industries, which are the natural consequence of the presence of so large a body of marketable timber. There are several saw mills where the Oak and Beech are cut up, but the chief industry is the manufacture of oaken staves for wine casks, which find ready sale in the valleys of the Main and the Rhine. Of the peasantry of the Spessart and its environments, very few are not connected in one way or another with the manufacture of lumber or staves or in getting out the raw material, while the great majority are directly dependent upon these sources of labor for their daily bread. If the Bavarian government, therefore, were to authorize the cutting of all marketable timber in this district, without regard to the maintenance of a sustained annual yield, a large number of people would soon be thrown out of employment and great suffering would inevitably result. To realize fully how severe this suffering would be, would entail upon the reader some study of the Bavarian peasant and the economic and social conditions under which he lives. His tools, his mode of life and his education differ but little from those of his ancestors, and his language is scarcely intelligible to his own countrymen of a better class. To such a man, the power to grapple with new conditions, to seek a fresh home and other means of employment, is denied. And even were this not the case, Germany, where the supply of labor exceeds the demand, in practically all the trades and especially in the case of com-

mon labor, offers a poor field to those in search of work.

To lumber on the principle of a sustained annual yield, in other words to take out of a forest in one year the quantity of wood which has actually been produced in that year, is the basis of forest management in Germany, because it has there been found to yield better returns upon the capital invested in the forest than any other form of management. If the sanctioned annual yield, and no more, be harvested each year, the forest will, under proper care, continue to produce the sanctioned annual yield for ever, just as a good investment continues to produce its annual interest. If the sanctioned annual yield be utilized with close regard to the silvicultural requirements of the forest, it will increase in proportion with the improvement in the condition of the forest as a whole. There are cases, however, among which is the Spessart, where the utilization of the sanctioned annual yield alone, may not prove immediately the best financial policy. This is sometimes the result of local economic conditions, but more often of the condition of the forest itself. The Spessart, from the standpoint of the forester, is not in good order. Its old Oaks and Beeches are still of high value, but many of them long ago passed their maturity. To leave them standing, is to incur loss from two sources: from the decay of the timber they contain; and because the space they occupy in the forest might be filled by sound healthy young trees, producing wood of good quality at a comparatively rapid rate. The best silvicultural measure would be, to remove, as soon as possible, all these Oaks and Beeches which have passed their maturity, without regard to the limit prescribed by the sanctioned annual yield. Then, after the forest has been put in good condition, by these "improvement cuttings," further utilization might be based upon its actual production, without danger of this production being in a measure offset by the presence, in the forest, of trees, which are not only growing exceedingly slowly, but many of which are losing rapidly in value through decay. However, in the Spessart, in order to continue to provide the peasants of the neighborhood with material for their sawmills and for the manufacture of staves, it is necessary to cut upon exceedingly conservative lines. The Oak of this region is divided into three well-defined classes, in point of age: Class I comprises Oak of about 400 years old. Class II, Oak 250 years old, and Class III, Oak 100 years old. In order, therefore, to maintain a sustained annual yield, Classes I and II, both of which are merchantable timber, must be removed slowly enough to allow Class III to be ready for the market by the time the removal of Classes I and II is effected.

Since the Oak is the more desirable tree in the Spessart, producing timber of high value while the Beech as a species suitable only for firewood is subordinate in importance, the first object of the management is the raising of merchantable Oak timber of as good a quality and in as short a time as possible. The Oak being a tree exceedingly intolerant of shade, has not the power of forming the dense mature stands characteristic of trees strongly tolerant of shade, as for example the Adirondack Spruce. In the case of pure woods of Spruce, the struggle for existence is prolonged indefinitely and the stand remains dense to a great age, because each tree which helps to form it, possesses the inherent power to endure excessive and long continued shade with but little detriment beyond decrease in its rate of growth. With the Spessart Oak, the case is different. The tree needs so much light, that it soon succumbs to suppression. The struggle for existence is consequently short, the stand thins out rapidly through the death of over-topped trees and becomes sparse and open at an early age. This may not seem to be a matter of much importance. It is, however, a source of so much difficulty, that it has rendered the raising of Oak timber in pure woods impossible in Germany. Not only does it prevent, by the formation of an insufficient, scanty stand, the full utilization of the space it occupies, but also results in the reproduction of short, branchy trunks and knotty defective timber. One of the most incontrovertible

of silvicultural laws establishes the impossibility of raising timber of good quality in a wood which has been open from an early age. For the production of long, cylindrical trunks free from branches, trees must have light from above, but as little side light as possible.

Realizing that it would be impossible to grow Oak timber in pure Oak woods, the Bavarian foresters had to find some other means of growing it. They turned to nature, and they found that Oak does not occur pure in the Spessart, but scattered in small groups and single trees among the Beech. They saw that the Oaks growing in this way were tall and straight, clean boled and cylindrical, and finer upon the whole than any Oak they had seen elsewhere. They noticed also that the Oaks were everywhere older than the Beech, with their crowns well above the leaf cover of the latter and forming what is called a "two-storied forest," the Oak above and the Beech below.

It was evident that "the Oak must have its head in the light and its feet in the shade," and that growing singly and in groups in dense stands of Beech, with its crown well above the general canopy, enjoying the full influence of the sunshine with its trunk shaded by the Beech around it, conditions were suited to its development. In other words it was clear that the Beech served as a nurse for the Oak, forcing it to grow towards the light and admitting that light only from above, with tall cylindrical trees, excellently adapted to use as timber, as the result. Incidentally also, Beech was seen to serve still another purpose, in shading the ground and covering it with its heavy leaf litter, thereby adding greatly to the moisture and fertility of the forest floor. To systematize a method of management easy of application, embodying the good features of nature's method without involving the same prodigal use of time, was the problem. If no attempt had been made to perpetuate the two-storied forest of Beech and Oak, it might certainly have continued to occur naturally, as in the past. To trust entirely to chance, however, in the perpetuation of a valuable timber tree, would not have been good forestry in the case of a species handicapped by infrequent seed years, strong demands upon light and a rate of growth so much slower than that of the Beech as to render it constantly liable to be choked out by the latter. In order to counteract these difficulties, the following plan was adopted:

Spots seldom more than a fraction of an acre in extent, suited especially to the Oak, were selected in mature Beech forest. These were cut clean of the Beech which covered them and sown broadcast with acorns. After four or five years when the young Oaks had obtained a start sufficient to enable them to hold their own against the faster growing Beech, the Beech wood surrounding the Oak groups was reproduced by natural means; that is, successive cuttings were made in it, by which the light necessary to the germination and growth of Beech seedlings was admitted to the soil, and after these had become established in sufficient quantity, the old Beech wood was gradually removed, allowing a young wood of Beech to take its place. At the same time, many young Beech sprung up in the Oak groups as well as around them, and the final result was exactly what had been desired—a two-storied forest with the Oak above and the Beech below. This system has been adopted permanently and every year fresh blanks are cut in the Beech woods and sown with acorns, thereby insuring to Spessart peasants of future generations an ample supply of the same fine Oak timber that the present generation is enjoying.

It may occur to the reader that although the conservative system of management adopted by the Bavarian government for the forests of the Spessart may contain some instructive features in view of the interests at stake, the silvicultural treatment of the Oak contains no hints of practical value for the management of American forests. It is true that so intricate a method involving large expense and much technical skill for its application, is justified in the Spessart only because the value of land and timber render it profitable. It is also true that such conditions do not yet exist generally in America. But because

a system cannot be adopted as it stands, it does not follow that some modification of it may not be employed where opportunity arises. The Spessart does not illustrate merely how Oak may be grown successfully in mixture with Beech. It teaches broad principles of sylviculture and proves the value of close observation. It was the study of these forests that induced Sir Dietrich Brandis, late Inspector General of Forests in India, to adopt in 1850 a similar system in Burma for the raising of Teak in mixture with Bamboo, the Teak forming the overwood and the Bamboo the underwood; a system which has served as a source of large annual revenue to the British crown. In our own northern woods we find the Hemlock and Pine associated in the same way as are the Spessart Beech and Oak, and in various parts of the United States other species form analogous cases, where nature points the way towards the best means of growing the local timber tree.

The student who has completed a visit to the Spessart will be within easy reach of the Steigerwald and the town forest of Bamberg, the one well known for its mixed forests of Scotch Pine and Beech and the other for the management of pure Scotch Pine woods under an elaborate system of clean cutting and sowing. He should also see something of the ancient town forest of Nuremberg, which consists chiefly of woods of Scotch Pine on a soil that is little more than pure sand. The forest has an interesting history and is an instructive example of what skill and perseverance can do in rearing woods in so poor a locality, where frequent insect ravages and long standing rights to the collection of litter go to make matters harder for the forester.

The Bayerischer Wald covers a mountain range in southwestern Bavaria, running parallel with the Böhmer Wald, a second range, the summit of which forms the dividing line between Bavaria and Bohemia. Here exist forest conditions markedly in contrast to those prevailing generally in Germany. In this isolated and sparsely settled region where lack of facilities for the transport of timber and distance from the market greatly lower stumpage values, the form of forest management is peculiarly instructive for Americans.

In Saxony, where the forests are chiefly pure Spruce and where natural reproduction has been almost entirely abandoned for clean cutting and planting, the American student will see a form of management impossible under our conditions. He will, however, have a chance to study the most striking example that Europe affords of the dangers and advantages of a purely financial forestry. In Saxony, the most remunerative use of forests is the growing of Spruce for paper pulp. The diameter at which Spruce can be used there for this purpose and its rate of growth are such that it pays best to cut it when it is about sixty years old. At this age, however, European Spruce does not bear full crops of seed, and natural reproduction under a rotation of sixty years is impossible. It is thus that the system of planting and sowing has come about, it having been found financially preferable to natural reproduction and a longer rotation.

The system is the most remunerative in Europe and there are Saxon forest ranges which yield a net revenue of twelve to fifteen dollars per acre per annum. On the other hand, it gives rise to dangers, from insects and from wind which are sufficiently serious to render its advisability an open question. The one is invited by the raising of pure evergreen woods of one species over large areas; the other by the clean cuttings, under which trees grown in closed woods become suddenly and fully exposed. The measures enforced to give the highest possible degree of safety against these dangers are largely peculiar to Saxony, particularly those which are taken as a safeguard against wind. The ranges are split up into a number of what are called cutting series, each series constituting an area which is treated separately. Since the heavy winds in Saxony are westerly, the object in the management of these cutting series is so to lumber them that the youngest woods occupy the west and the oldest the east side. With this in view, cuttings proceed always from

east towards west, with the result that the closed forest is never suddenly exposed on the west side. A normal "cutting series," or in other words one in which there is a regular gradation of woods of different ages, presents a curious appearance and consists of a series of even aged blocks arranged like the steps of a stairway, from the youngest plantation to the mature stand, and each protecting the other from the wind. This elaborate precautionary measure has one weak point. So long as the heavy winds are westerly, it affords an entirely adequate means of protection. Now and again, however, a strong wind comes from the east, when it is free to work great havoc on the unprotected mature woods which bound the cutting series on that side.

The Schwarzenberg forest district, hard against the Bavarian border, contains some representative forest ranges among which are the most remunerative in the kingdom.

Having seen the systems applied to the mixed forests of the Schwarzwald and in the pure stands of Spruce in Saxony, the student will have had an opportunity to compare the two great types of forest management in Europe. The painstaking, patient methods by which reproduction is obtained in the Schwarzwald and a high degree of safety attained is in strong contrast to the Saxon system in which grave dangers are invited by direct violation of the silvicultural laws governing the natural development of a forest.

It is a question whether the student will find in Prussia, except upon the Pine Barrens, many notable forms of forest management which are not quite as forcibly illustrated in southern Germany. The Prussian working plan method is the most intricate of all and forest management generally in Prussia is more hampered by red tape than anywhere else in Europe. He should not fail, however, to visit the Salmuenster range in southwest Prussia, where Oak is reproduced naturally in instructive contrast to the treatment of the same species in the Spessart.

These are a few of the forest ranges which Americans have found instructive. To include them all would have been to make a catalogue of this paper. The list which has been given is suggestive only in its purpose. Before one has been long in Europe, he will be able to make his own plan of campaign far better than another can make it for him. The main point is to weigh that plan thoroughly, and above all, with a realization of the fact that European forestry, although simple in purpose, is intricate enough in its details to bewilder any one who approaches it in a desultory way.

It is also well to remember at the very outset, that no man can master the details of European forest management in a year, and that the profit gained from the trip will depend largely upon the selection made of those features to be especially studied. The American forest student will find scientific research highly developed in European forestry and he can waste a good deal of his time over abstruse lines of investigation which not infrequently owe their origin solely to the yearning of a scientist to investigate something. He should never lose sight of the fact that his main purpose in going to Europe is to see the effect of forestry upon the forest. The greatest practical benefit to him lies in the study of the woods themselves and of the working plans under which they are managed.

The student who goes abroad for a year had no time for a European forest school. Should he spend an extra six months in a semester at one of the several forest schools in Germany, he will have an interesting experience. However, one goes abroad to get what he cannot get at home, and the establishment of forest schools in this country has done away entirely with the necessity for students to attend them in Europe. Before this was the case, the forest school at Munich was most often chosen by Americans. It has an eminent corps of instructors, and Professor Henrich Mayer, who handles silviculture and forest utilization, adds to his remarkable brilliancy as a silviculturist an intimate knowledge of American forests and American conditions.

Living is proverbially cheap in Europe, particularly in the villages and smaller

towns. In those cases where the student spends a month or more upon one range, it is customary for him to pay a fee of twenty-five dollars per month to the forest officer. No fee is asked for short visits to forest ranges and the invariable courtesy of European forest officials makes these possible to anyone who bears the proper credentials. One thousand dollars is sufficient to pay all necessary expenses for a year in the woods of Europe, and permits of a fair amount of travelling. Less than that sum would curtail one's movements somewhat undesirably.

BOOK LIST.

All books mentioned in this list will be sent post paid by the publishers upon receipt of prices quoted. In writing mention this pamphlet.

A Primer of Forestry, Part I. GIFFORD PINCHOT. Bulletin 24 of the Bureau of Forestry, U. S. Department of Agriculture. Part I. contains chapters on "The Life of a Tree," "Trees in the Forest," "The Life of a Forest," "Enemies of the Forest."

Schlich's Manual of Forestry. Published in five volumes by Bradbury, Agnew & Co., Bouverie Street, London. Vols. I. and II. are especially valuable to a beginner. This can be imported for a little over $12.00.

Elements of Forestry. F. B. HOUGH. R. Clark Co., Cincinatti. $1.50. One of the few American books on forestry. Good; though out of date in some respects.

North American Forests and Forestry. ERNEST BRUNCKEN. G.P. Putnam's Sons, New York. $1.50. Expository in character, and written for the general reader.

The White Pine. GIFFORD PINCHOT and H. S. GRAVES. The Century Co., New York. $1.00.

The Adirondack Spruce. GIFFORD PINCHOT. G. P. Putnam's Sons, New York. $1.00. This, like the "White Pine," is a study of the habits and growth of an important lumber tree and of its rate of wood accretion per tree and per acre, with conclusions drawn from this study as to the financial possibility of practical forestry in dealing with the species.

Practical Forestry in the Adirondacks. H. S. GRAVES. Bulletin 26 of the Bureau of Forestry, U. S. Department of Agriculture. Sold for 15 cents by the Superintendent of Documents, Union Building, Washington, D. C.

Working Plan for Township 40. In preparation. Will appear during the summer of 1901 as Bulletin 30 of the Bureau of Forestry of U. S. Department of Agriculture. A report making recommendations of the forest management of the Township containing Racquette Lake in the Adirondacks.

What is Forestry? B. E. FERNOW, Bulletin 5; Bureau of Forestry, U. S. Department of Agriculture. Out of print but should be in public libraries.

The Forest Nursery. G. B. SUDWORTH. Bulletin 29, Bureau of Forestry, U. S. Department of Agriculure. Chapters on "Collecting Tree Seeds and Care before Planting," "Propagation of Trees from Seeds and Cuttings," "Wintering and Planting Seedlings," "Use of Wild Seedlings," "List of Useful Timber Trees to Plant."

Manual of Botany. ASA GRAY. (6th edition.) American Book Co., New York. $1.60; Pocket edition $2.00. A key to the flora of the Northeastern States.

How Plants Grow. ASA GRAY. American Book Co., New York. 80 cents. An understanding of the way which a tree grows is of the first importance to a forester.

Illustrated Flora of the Northern United States. 3 vols. N. L. BRITTON and A. BROWN. $9.00 per set. A

thorough and valuable guide to the flora of the Northern part of the Continent. Chas. Scribner's Sons, New York.

Flora of the Southern States. A. W. CHAPMAN. American Book Co., New York. $4.00. An excellent key to the Southern flora.

Trees of the Northern United States. E. A. APGAR. American Book Co., New York. $1.00. A brief and compact key for the identification of trees, chiefly by the leaf. Illustrated.

Our Native Trees, and How to Identify Them. H. L. KEELER. Charles Scribner's Sons, New York. $2.00. This book tries to do somewhat more than identify the trees by name, and its statements are, on the whole, accurate.

Revised Text Book of Geology. J. D. DANA. American Book Co., New York. $1.40. Some knowledge of geology is necessary in forestry. This is a good book for a beginner.

Physical Geography. W. M. DAVIS. Ginn & Co., Boston, Mass. $1.25. A book which should be read by all who intend to give any of their time to the study or practice of forestry.

The Earth Modified by Human Action. G. P. MARSH. Charles Scribner's Sons. $3.50. The chapter on forests is especially interesting and valuable.

Silva of North America (12 vols.). C. S. SARGENT. Houghton, Mifflin & Co., Boston, Mass. This is the best book of reference on North American trees.

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